

SR 18: 180th Avenue SE to Maple Valley (Jenkins Creek)

USACE 1999-4-00171

Northwest Region

2006 MONITORING REPORT

Wetland Assessment and Monitoring Program

Issued May 2006



**Washington State
Department of Transportation**

Environmental Services Office

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SR 18: 180th Avenue SE to Maple Valley (Jenkins Creek)

USACE 1999-4-00171



General Site Information		
USACE IP Number	1999-4-00171	
WSDOT Contract Number	C6008	
Mitigation Location	SR 18, south of 256 th , west of Jenkins Creek, King County	
Initial Monitoring Period	2004 – 2013	
Year of Monitoring	3 of 10	
Area of Project Impact	0.81 acres	
Type of Mitigation	Wetland Creation	Wetland Restoration
Area of Mitigation	0.92 acres	0.56 acres
Type of Mitigation	Wetland Enhancement	Wetland Preservation
Area of Mitigation	4.43 acres	0.35 acres

Summary of Monitoring Results and Management Activities

Performance Criteria	2006 Results	Management Activities
Permit Requirement (USACE)		
Creation and restoration areas will be saturated to the surface for 12.5 percent of the growing season.	Not present in all areas.	
Success Standards		
1. Create at least 1.48 acres that support wetland hydrology.	One third of the creation/restoration areas support wetland hydrology.	
3a. <u>At least</u> 60% cover by at least three non-invasive native herbaceous FACW and wetter species in the emergent wetland.	80% (CI _{90%} = 75-85%) 14 FACW and wetter species	
3b. <u>At least</u> 15% cover by at least three species of facultative and wetter native woody plant species in the forested wetland.	26% (CI _{80%} = 22-30%) 15 FAC and wetter species	
4. <u>At least</u> 15% cover by at least three species of native woody plant species in the upland buffer.	34% (CI _{80%} = 27-41%)	
5a. Control all King County-listed Class A, B-designate, and County-selected priority noxious weed species.	Weed control.	Ongoing weed control
5b. Less than 25% cover by reed canarygrass in the enhancement and restoration areas.	12% (CI _{80%} = 9-16%)	Ongoing weed control
9. Habitat structures identified in the plans are in place and functional.	Present in 2005-2006	

Report Introduction

This report summarizes Year-3 monitoring activities at the State Route (SR) 18: 180th Avenue SE to Maple Valley (SR 18 Jenkins Creek) mitigation site. Included is a description of the site, the success criteria, an explanation of how the site was monitored, and a discussion of how it is developing. Monitoring activities in 2005 and 2006 included vegetation surveys, hydrology observations, and photo-documentation.

What is the SR 18 Jenkins Creek Mitigation Site?

This site was developed as compensation for 0.81 acre of wetland impacts resulting from capacity and safety improvements to SR 18 between 180th Avenue SE and Maple Valley Road. The site contains a portion of Jenkins Creek and its confluence with an unnamed tributary to Jenkins Creek. Improvements at the mitigation site included new spans over Jenkins Creek that allow increased flows to pass without increasing velocity. In addition, WSDOT replaced an undersized metal culvert that conveyed the unnamed tributary under SR 18 with a 48-foot long, three-sided arch structure. Ecological connectivity was enhanced by replacing a 25-foot long bridge and associated fill with a 256-foot long bridge over the main channel of Jenkins Creek, creating a below-grade travel corridor for wildlife. As mitigation, Jenkins Creek and its unnamed tributary were enhanced with large woody debris and by planting native woody species along the riparian corridor. The site is intended to provide areas of wetland creation and restoration adjacent to enhanced wetlands. The intended functions include increased biofiltration, fish and wildlife habitat, food chain support, temperature moderation, floodwater storage, contaminant retention, nutrient removal, and organic material export.

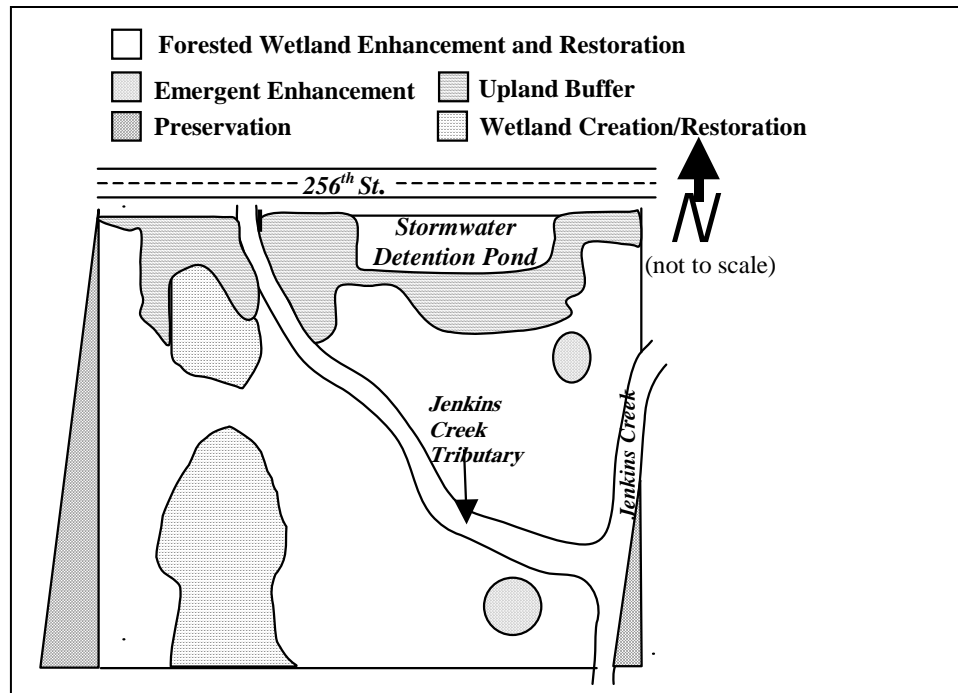


Figure 1 Site Sketch

The site is a combination of enhanced, created, and restored emergent and forested wetlands. An upland buffer exists along the north end of the site. Appendix 1 provides site directions.

What are the performance criteria for this site?

Permit Requirement 1

Creation and restoration areas must be saturated to the surface. Saturation must be to the surface for at least 12.5 percent (30 consecutive days) of the growing season (March 1 through October 31). Saturation will be measured by observing soil saturation to the surface or by utilizing water wells.

Performance Standard 1

Creation and restoration areas must demonstrate a total of 1.48 acres or more that support wetland hydrology.

Performance Standard 3a

Three years after planting, emergent wetland mitigation areas will be comprised of a planted and native naturally colonizing plant community with 60% or more areal (*sic*) cover involving at least three non-invasive herbaceous plant species adapted for life in saturated soil conditions (facultative-wet or wetter).

Performance Standard 3b

Forested wetland mitigation areas will be comprised of a planted and native naturally colonizing plant community with 15% or more areal (*sic*) cover involving at least three species of woody plant species adapted for life in saturated soil conditions (facultative or wetter).

Performance Standard 4

Three years after planting, upland buffer zones will be comprised of a planted and native naturally colonizing plant community with 15% or more areal (*sic*) cover involving at least three woody plant species.

Performance Standard 5a

All King County-listed Class A, B-designate, and County-selected priority noxious weed species will be controlled in the season they are first identified on the mitigation site.

Performance Standard 5b

The enhancement and restoration areas shall contain no more than 25% areal (*sic*) cover by reed canarygrass at any point during the lifetime of the monitoring period.

Performance Standard 9

Habitat structures identified in the plans are still in place and functional.

Appendix 1 provides the complete text of the performance criteria for this project, and Appendix 4 shows the planting plan (Antieau and Krueger 2001).

How were the success standards measured?

To evaluate standards for vegetative cover, a baseline was established parallel to 256th Street (Figure 2). Twenty-six sampling transects were randomly placed perpendicular to the baseline. The line intercept method was used to estimate woody cover (Performance Standards 3b, and 4), and the point intercept method was used to estimate invasive species cover (Performance Standards 3a, 5a and 5b).

Primary and secondary field indicators of wetland hydrology (Ecology 1997) were recorded to address Permit Requirement 1. These observations were made during four site visits in March and April 2006. Five soil pit locations were also selected in specific parts of the creation, restoration, and enhanced wetland areas of the site. Wetland hydrology was assessed at these locations during the site visits.

Photographs were taken at permanent photo points to address Permit Requirement 2.

To address Performance Standard 1, Washington State Department of Transportation (WSDOT) staff performed a wetland delineation in April 2006 using methods described in the *Washington State Wetlands Identification and Delineation Manual* (Ecology 1997) and a Global Positioning System (Trimble TSCI data logger).

Habitat structures were counted to address Performance Standard 9.

For additional details on the methods, see Appendix 2 of this report or view the WSDOT Wetland Mitigation Site Monitoring Methods at: <http://www.wsdot.wa.gov/environment/biology/docs/MethodsWhitePaper052004.pdf>

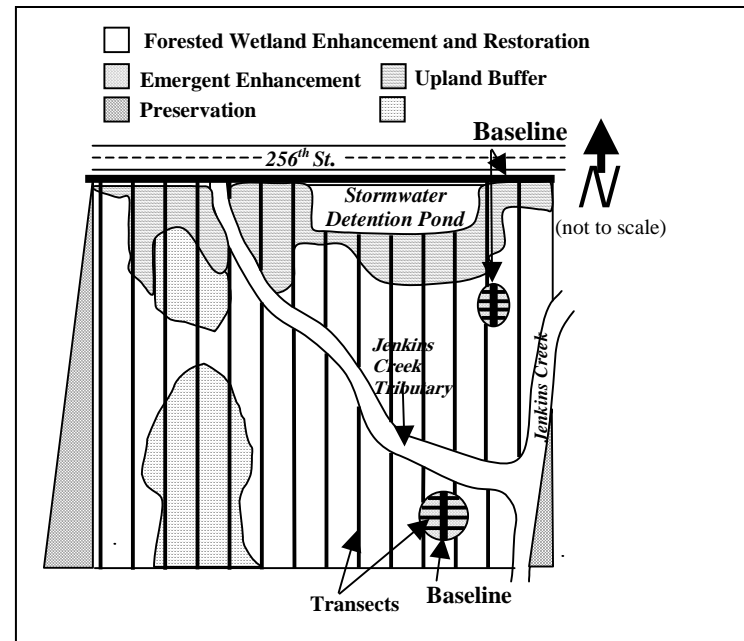


Figure 2

2006 Sample Design

How is the site developing?

The site is developing well in many respects. Native planted and naturally colonizing species are well established, and an increase in many functions is being provided. Biofiltration is provided by the establishment of emergent vegetation along portions of the creek banks. Fish and wildlife habitat have been enhanced with the addition of large woody debris and plantings along the creek and in wetland areas. Woody species (listed in Appendix 3) provide food and foraging opportunities for birds and wildlife. Establishment of *Salix* species (willows) along the riparian zone is beginning to provide temperature moderation in the creek and production and export of organic matter. Floodwater storage was observed during and after large winter storm events. However, three years of hydrology data and a mid-course delineation indicate that the site has not developed as much wetland acreage as intended.

Results for Permit Requirement 1

(Creation and restoration areas must be saturated to the surface for at least 12.5 % of the growing season):

The hydrology criterion was met in the northern creation and restoration area (Photo 1), and does not appear to be met in the southern creation and restoration area. Appendix 3 summarizes hydrology data collected in March and April 2006. (Also, see results for Performance Standard 1 below).



Photo 1

**Standing water in the created forested wetland
(March 2006)**

Results for Performance Standard 1

(Creation and restoration areas must demonstrate a total of 1.48 acres or more that support wetland hydrology):

Based on a delineation conducted in April 2006, wetlands are present in approximately 0.5 acres of the intended creation and restoration zones. The area in the northwest supports wetland hydrology (Photo 2). This wetland is typically inundated with 1 to 2 decimeters of standing water during the early part of the growing season (Appendix 3). The larger creation and restoration area in the south end of the site does not appear to support the intended wetland hydrology.



Photo 2

Inundation in the northwest creation and restoration area (March 2006)

Results for Performance Standard 3a

(≥60% cover by at least three non-invasive native herbaceous facultative-wet and wetter species in the emergent wetland):

The estimated cover provided by native facultative-wet (FACW) and wetter herbaceous species is 80% ($CI_{90\%} = 75\text{-}85\%$) in the emergent wetland. During sampling, 14 native, non-invasive FACW and wetter herbaceous species were encountered (Photo 3). Appendix 3 provides a list of native, non-invasive FACW and wetter herbaceous species observed in the emergent zones.



Photo 3

***Lysichiton americanus* (skunkcabbage) in the emergent wetland (April 2006)**

Results for Performance Standard 3b

(≥15% cover by at least three species of facultative and wetter native woody plant species in the forested wetland):

Cover of facultative (FAC) or wetter native woody plant species is estimated to be 26% ($CI_{80\%} = 22-30\%$). This estimate exceeds the standard of 15 percent aerial cover. Woody plants are well established and average 1.5 to 2 meters in height. During sampling, 16 native woody species were observed in the forested wetland mitigation areas (Photo 4). Appendix 3 contains a list of native woody plants in the forested wetland mitigation areas.



Photo 4

**Woody cover in the forested wetland zone
(August 2005)**

Results for Performance Standard 4

(≥15% cover by at least three species of native woody plant species in the upland buffer):

Native woody species in the upland buffer zones were estimated to provide 34% ($CI_{80\%} = 27-41\%$) aerial cover. This estimate exceeds the standard for the third year. Woody species in the buffer are well established and recruitment of native woody species has augmented the cover provided by planted woody species. Twenty native species were observed during monitoring activities in the upland buffer zones.

Results for Performance Standard 5a

(Control all King County-listed Class A, B-designate, and County-selected priority noxious weed species):

Two King County-listed Class, B-designate species were observed during monitoring activities. Only a few individuals of *Senecio jacobaea* (tansy ragwort) (King County Class B Weed), and *Cytisus scoparius* (Scot's broom) (King County Class B Weed) were observed. Cover of these species is very low. Ongoing weed control efforts have targeted all King County-listed noxious weed species the season they are first identified on the mitigation site. Weed control efforts have been highly effective in controlling any species that may impede site development.

Results for Performance Standard 5b

(<25% cover by reed canarygrass in the enhancement and restoration areas):

The enhancement and restoration areas are estimated to contain 12% ($CI_{80\%} = 9\text{-}16\%$) aerial cover of *Phalaris arundinacea* (reed canarygrass). This species is mostly limited to areas adjacent to Jenkins Creek and the tributary to Jenkins Creek that runs through the site. Weed control seems to be effective on site.

Results for Performance Standard 9

(Habitat structures identified in the plans are still in place and functional):

The habitat structures specified on the planting plans are present. Monitoring crews counted 8 stumps with rootwads, 2 logs with root wads, 2 log rolls, 4 brush piles, and 20 herpetofaunal hibernacula (rock piles).

Additional Information

The development of forested and emergent wetland classes and the addition of several different types of habitat structures have provided habitat for shorebirds, waders, aerial searching birds, and passerines on site. Appendix 3 lists the wetland dependent bird species observed. A bird nest was observed in the forested wetland zone in Spring 2006 (Photo 5), and both Willow Flycatcher (*Empidonax traillii*) and Common Yellowthroat (*Geothlypis trichas*) have used the wetland buffer for nesting.



Photo 5

Bird nest in the Forested Wetland at Jenkins Creek (March 2006)

Appendix 1 – Success Standards

The following excerpt is from the *SR 18: 180th Ave SE to Maple Valley, Washington (MP 12.57 to MP 16.55) Final Wetland Mitigation Plan* (Antieau and Krueger 2001). The criteria addressed this year are identified in **bold** font. Other tasks and standards will be addressed in the indicated monitoring year.

Mitigation Goals

The Jenkins Creek wetland/floodplain complex provides important wetland and stream functions, and is a high quality system despite the surrounding levels of development. In the rapidly urbanizing Covington Sub-basin, the Jenkins Creek wetland system provides significant wildlife habitat, including habitat for migration/travel, escape, resting, forage, and reproduction. Jenkins Creek supports salmonid populations. Adjacent wetlands are integral to in-stream habitat, providing wintering habitat, water temperature moderation, inputs of detritus and woody debris, and escape cover.

While the Jenkins Creek system currently provides significant wildlife and fish habitat, the overall quality and quantity of functioning could be improved using restoration and enhancement of degraded wetland and stream areas in that system. The proposed compensatory mitigation for this project is intended to replace wetland types and wetland functions that will be lost due to project construction. Proposed mitigation is anticipated to mitigate loss of the following functions:

Fish and wildlife habitat: mitigation will increase available habitat for fish and wildlife, increase habitat and floodplain connectivity, and provide additional winter refugia for fish.

Food chain support: mitigation will increase available wildlife forage material and detrital input to Jenkins Creek.

Stream temperature moderation: mitigation will increase shade and canopy closure over the streams, while also enhancing potentials for recruiting large woody debris.

Flood water attenuation: mitigation will increase the floodplain area.

Nutrient/contaminant trapping: mitigation will provide an increased area of vegetated floodplain having opportunity to intercept and transform road-runoff contaminants, fertilizers, herbicides, and other pollutants from residential and agricultural activities upstream.

Aside from wetland preservation, a combination of creation, restoration, and enhancement activities will be used to obtain these benefits. Overall, these activities will attempt to achieve 5.71 acres of palustrine forested wetland and 0.20 acre of emergent wetland as mitigation for the loss of 0.81 acre of palustrine forested and emergent wetland.

Objectives and Performance Standards

Objective 1: Wetland Areal Extent and Wetland Hydrology

The wetland mitigation actions involving creation and restoration must demonstrate a total of 1.48 acres or more that support wetland hydrology (Table 4). Hydrology in zones of creation and restoration will be monitored in Monitoring Years One, Two, Three, Five, Seven, and Ten. Monitoring wells will be left in place to facilitate hydrologic data analysis during plant establishment.

Performance Standards: Monitoring Years One through Five

PS1. Creation and restoration areas must demonstrate a total of 1.48 acres or more that support wetland hydrology.

Monitoring/Delineation Schedule

A determination of areal extent will be made during the hydrology monitoring period using standard wetland delineation methodology using these monitoring data. The boundary and areal extent of the area supporting wetland hydrology will be determined using an instrument survey or other reliable method of determining area.

Potential Contingency Actions

Regrade the site to achieve the required acreage supporting hydroperiods that meet the hydrology criterion for wetlands (Environmental Laboratory 1987)- “hydrology criterion” inundation or saturation within 12 inches of the surface for 12.5% of the growing season March 1-October 31.

Objective 2: Vegetation

The mitigation program is intended to enhance 0.20 acre of emergent wetland (3 percent), enhance 4.23 acres of forested habitat (72 percent), and create and restore 1.48 acres of forested wetland (25 percent) (Table 3). Each of these habitats is expected to be dominated by native plant species. Wetland plant communities are expected to appear to be succeeding toward the intended forested and emergent communities.

Performance standards: Monitoring Year One (one year after planting)

PS2. At the end of the first growing season all planted material shall be alive and healthy (all dead material will be replaced). The enhancement and restoration areas shall contain no more than 25% areal (*sic*) cover by reed canarygrass at any point during the lifetime of the monitoring period.

Performance Standards: Monitoring Year Two and Three

PS3. Three years after planting, emergent wetland mitigation areas will be comprised of a planted and native naturally colonizing plant community with 60% or more areal (*sic*) cover involving at least three non-invasive herbaceous plant species adapted for life in saturated soil conditions (facultative-wet or wetter). Forested wetland mitigation areas will be comprised of a planted and native naturally colonizing plant community with 15% or more areal cover involving at least three species of woody plant species adapted for life in saturated soil conditions (facultative or wetter).

PS4. Three years after planting, upland buffer zones will be comprised of a planted and native naturally colonizing plant community with 15% or more areal (*sic*) cover involving at least three woody plant species.

PS5. All King County-listed Class A, B-designate, and County-selected priority noxious weed species will be controlled in the season they are first identified on the mitigation site.

Reed canarygrass (a King County Weed of Concern) is expected to be present during the life of this mitigation effort due to the abundant and adjacent source of propagules, as well as the presence of reed canarygrass on the mitigation site. **The enhancement and restoration areas shall contain no more than 25% areal (*sic*) cover by reed canarygrass at any point during the lifetime of the monitoring period.**

Performance Standards: Monitoring Year Five, Seven, and Ten

PS6. Five years after planting, emergent wetland mitigation areas will be comprised of a planted and native naturally colonizing plant community with 75% or more areal (*sic*) cover involving at least three non-invasive herbaceous plant species adapted for life in saturated soil conditions (facultative-wet or wetter). Forested wetland mitigation areas will be comprised of a planted and native naturally colonizing plant community with 25% or more areal (*sic*) cover involving at least three species of woody plant species adapted for life in saturated soil conditions (facultative or wetter).

PS7. Five years after planting, the buffer will be comprised of a planted and native naturally colonizing plant community with 25% or more areal cover involving at least three woody plant species.

Monitoring Schedule

Once during the middle part of the growing season in Monitoring Years One, Two, Three, Five, Seven, And Ten.

Potential Contingency Actions

Before the beginning of Monitoring Year One, all dead or unhealthy plants will be replaced. Thus, monitoring 100% survival in Monitoring Year One (Performance Standards PS3) will be verifying this.

If the site does not meet performance standards PS4 and PS5 (Monitoring Year Three), additional planting will be conducted. Live, containerized plant material will be replanted and monitored to assure that coverage meets performance standards S6 and S7 (Monitoring Year Five).

If the site does not meet performance standards PS6 (vegetation not succeeding in directions that displace or weaken reed canarygrass), and PS7 and PS8 (Monitoring Year Five), resource agencies will be consulted for advice on further measures to remedy problems at the site. The monitoring schedule will be extended and such reasonable measures will be conducted as necessary to establish appropriate wetland vegetation. WSDOT will perform all reasonable measures considered necessary to establish and maintain a functioning wetland/buffer system that meets the goals and objectives of this monitoring plan.

The mitigation plan uses and promotes the growth of native vegetation. **King County Class A, B-designate, and County-selected priority noxious weed species will be controlled in the season they are first identified on the site. In the event that reed canarygrass in the enhancement and restoration areas exceeds 25% areal (*sic*) cover at any point during the monitoring period, a range of techniques will be employed to bring the area into compliance. These techniques include hand pulling and off-site disposal, hand-spraying or wiping with Rodeo, flaming, trampling (crushing), and/or mowing.**

Objective 3: Wildlife Habitat

Wildlife cover and forage availability for birds and small mammals should increase substantially. Addition of native plants, logs with rootwads, logs, log rolls, brush piles, and herpetofaunal hibernacula will increase habitat diversity and structure in newly revegetated areas. Generally, the creation, restoration, enhancement, and preservation of forested and emergent wetland habitats are intended to provide feeding, breeding, and resting habitat for birds, small mammals, amphibians, and reptiles. Such activity will also benefit fish in Jenkins Creek and its tributary by reducing water temperatures and contributing detrital and woody debris.

Performance Standards: Monitoring Year One (one year after planting)

PS8. All habitat structures identified on the plan have been placed on the site.

Performance Standards: Monitoring Year Two and Three

PS9. Habitat structures identified in the plans are still in place and functional.

Performance Standards: Monitoring Year Five, Seven, and Ten
None.

Monitoring Schedule

Once during Monitoring Years One, Two, and Three.

Potential Contingency Actions

Install or replace habitat structures that are missing, damaged, lost, or non-functional.

MONITORING PLAN

WSDOT's Wetland Mitigation Monitoring Program (Monitoring Program) uses objective-based monitoring to document success and change in WSDOT's wetland mitigation sites. Monitoring protocols are based on specific objectives written in each project's wetland mitigation plan, combined with evaluation of current site conditions. A customized monitoring program is developed for each site. The Monitoring Program uses a variety of ecological monitoring techniques and protocols, including those outlined in Horner and Raedeke (1989) and in WSDOT (2000b). Many standard techniques such as permanent transect lines, plots, and photo points are still used. However, the number and placement of those depend on specific site objectives. Locations of photopoints and transects, if used, are not selected until the first year of monitoring. Statistical precision and accuracy are used to determine the number and configuration of transects and sample plots.

The Monitoring Program will begin monitoring hydroperiod in the wetland creation portion of the site immediately after completion of the grading plan, but prior to construction of the planting plan. During this period, hydrology will be monitored at least twice monthly using shallow groundwater wells or other means of observing soil saturation/inundation. After the planting plan has been constructed, Monitoring Year One will commence at the start of the subsequent year. Beginning with the first growing season after construction of the planning plan, the Monitoring Program will monitor the mitigation site for at least ten years. Parameters to be monitored during this ten-year period include hydroperiod and vegetation, as described above.

Reports for the ten-year monitoring period (including a report for each Monitoring Years One, Two, Three, Five, Seven, and Ten) will be issued to the Corps of Engineers Seattle District Regulatory Branch, Washington State Department of Ecology, King County Department of Development and Environmental Services, and other appropriate resource agencies for review and comment. Successful mitigation will be measured by attainment of the performance standards described in this mitigation plan document. Monitoring may be curtailed early or reduced in intensity if the mitigation effort meets the stated performance standards earlier than anticipated.

CONTINGENCY ACTIONS

WSDOT anticipates the mitigation goal will be achieved by accurately completing the grading and planting plans. However, contingency actions, as described above, may be needed to correct unforeseen problems. Such actions may consist of regarding the site in the case of insufficient hydroperiod, or replanting the site in the case of planting failure. However, natural recruitment of native wetland species and upland species (in the buffer) will be counted toward achieving performance standards for Vegetation. Should areal coverage of wetland or buffer plants consistently fall short of desired performance standards, WSDOT will consult with appropriate agencies in determining what additional measures could be implemented to ensure establishment of viable wetland and upland plant communities.

Appendix 1B – SR 18 Jenkins Creek USACE Regulatory Branch

The following excerpt is from the *SR 18: 180th Ave SE to Maple Valley, Washington, Updated Wetland Mitigation Plan Addendum* (Brown 2002).

From USACE Regulatory Branch Letter (2002, p.2) (Permit 1999-4-00171)

The performance standard for wetland hydrology listed below supercedes the performance standard described in the “Final Wetland Mitigation Plan, SR 18: 180th Avenue SE to Maple Valley, Washington (MP 12.57 to MP 16.55) by Clayton J. Antieau, wetland Biologist and Paul. W. Krueger, Landscape Designer, and amended by John Maas and Terry Sullivan, WSDOT, Northwest Region” dated January 2001 and “SR 18: 180th Avenue SE to Maple Valley, Washington, Updated Wetland Mitigation Plan Addendum” dated August 15, 2002.

Performance Standard 1: Creation and restoration areas must be saturated to the surface. Saturation must be to the surface for at least 12.5 percent (30 consecutive days) of the growing season (March 1 through October 31). Saturation will be measured by observing soil saturation to the surface or by utilizing water wells.

In sandy soils, water must be standing in the well at 6 inches or less for at least 12.5 percent of the growing season. **In non-sandy soils, water must be standing in the well at 12 inches or less for at least 12.5 percent of the growing season.**

Appendix 1C – SR 18 Jenkins Cr. ECY Permit 1999-4-00171

From Ecology Water Quality and Certification Permit 1999-4-00171 (2000, p. 7)

The Applicant shall prepare and submit annual monitoring reports to Ecology's Sarah Suggs and Sandra Manning, P.O. Box 47600, Olympia, WA 98504-7600 no later than December 30th of each year following the first year of project completion. **Each year's monitoring report shall include photographic documentation of the project taken from permanent reference points (Figure 2C.1).**

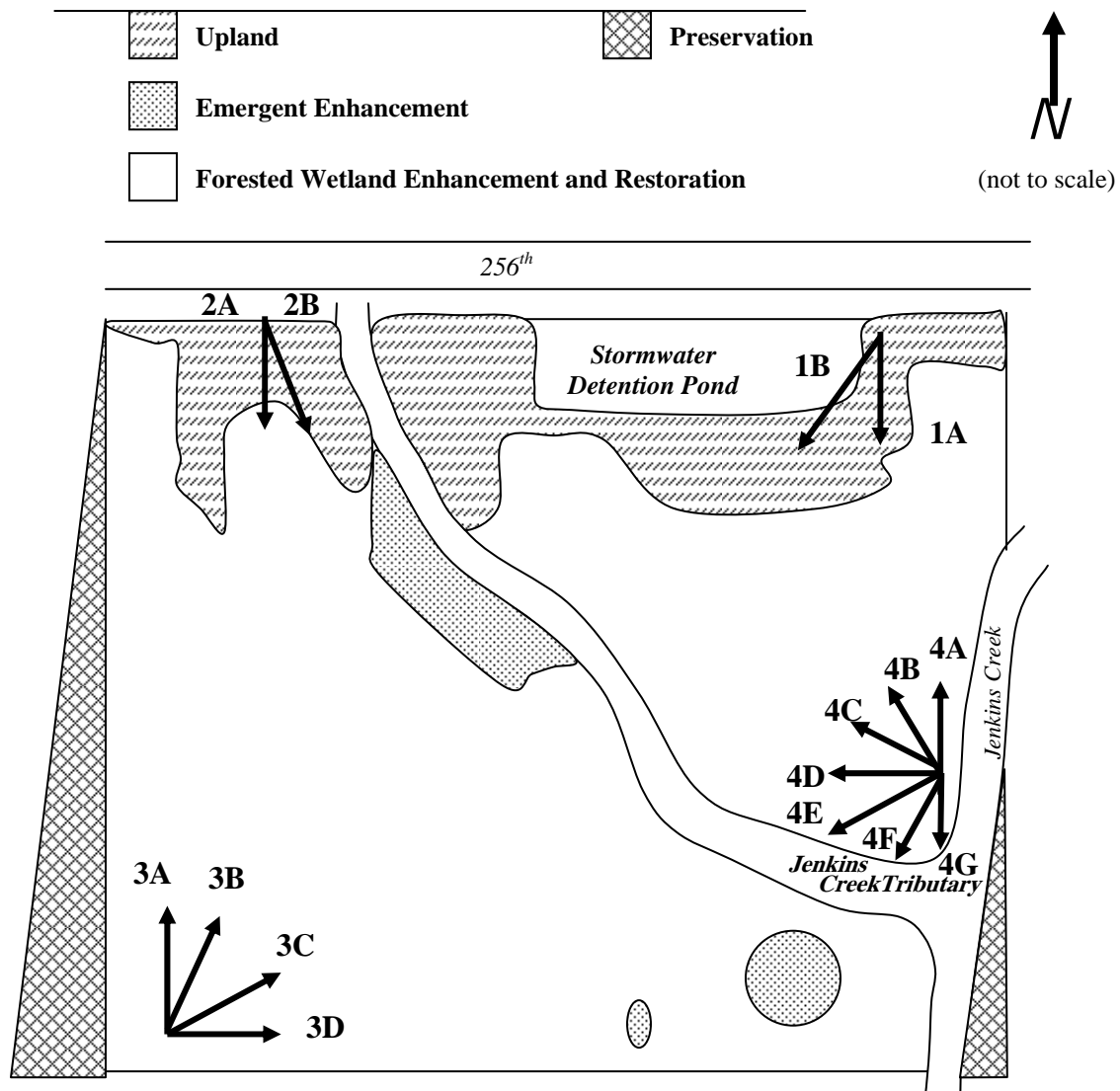


Figure 1C.1 SR 18 Jenkins Creek Site Sketch with Photo Point Locations
(Photos Shot 3/30/05)



Photo Point 1A



Photo Point 1B



Photo Point 2A



Photo Point 2B



Photo Point 3A



Photo Point 3B



Photo Point 3C



Photo Point 3D



Photo Point 4A



Photo Point 4B



Photo Point 4C



Photo Point 4D



Photo Point 4E



Photo Point 4F



Photo Point 4G

Appendix 2 - Methods

To evaluate standards for vegetative cover, a 265-meter baseline was established parallel to 256th Street (Figure 2). Twenty-six sampling transects were randomly placed perpendicular to the baseline using a systematic random sampling method.

The line intercept method was used to estimate woody cover in the forested wetland and the upland buffer (Performance Standards 3b, and 4). Fifty-eight 50-meter lines were randomly placed along the sampling transects in the forested wetland. Forty-seven 10-meter lines were randomly placed along sampling transects in the upland buffer.

The point intercept method was used to estimate invasive species cover (Performance Standards 5a and 5b). Twenty-six randomly positioned 100-meter point-line sample units (200 points each) were placed along sampling transects across the entire site.

To evaluate the cover of the emergent wetland mitigation areas, two baselines were established. Twenty-six sampling transects were randomly placed perpendicular to the baselines. To estimate emergent wetland species cover, data were collected from 953 random point locations (Performance Standard 3A).

Primary and secondary field indicators of wetland hydrology (Ecology 1997) were recorded to address Permit Requirement 1. These observations were made during four site visits in March and April 2006. Five soil pit locations were also selected in random wetland areas of the site. Wetland hydrology was assessed at these locations during the site visits.

Photographs were taken at permanent photo points to address Permit Requirement 2.

To address Performance Standard 1, Washington State Department of Transportation (WSDOT) staff performed a wetland delineation in April 2006 using methods described in the *Washington State Wetlands Identification and Delineation Manual*

$$n = \frac{(z)^2 (s)^2}{(B)^2}$$

z = standard normal deviate
 s = sample standard deviation
 B = precision level
 n = unadjusted sample size

(Ecology 1997) and a Global Positioning System (Trimble TSCI data logger).

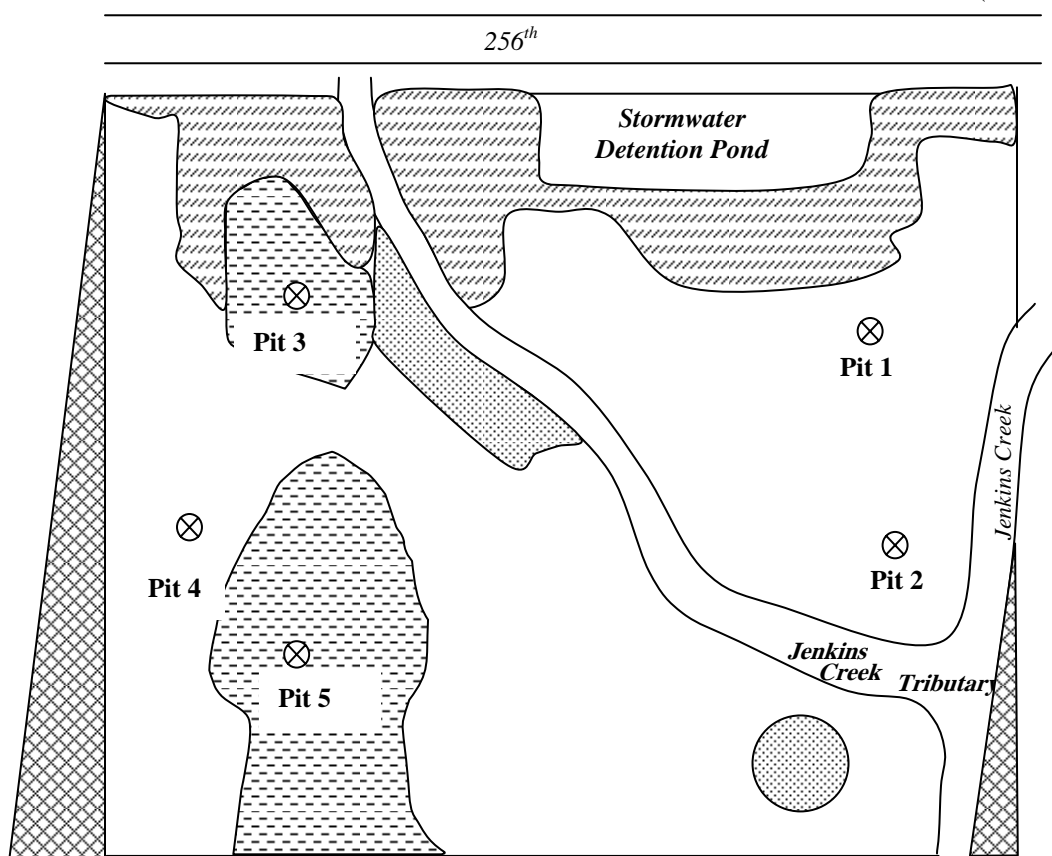
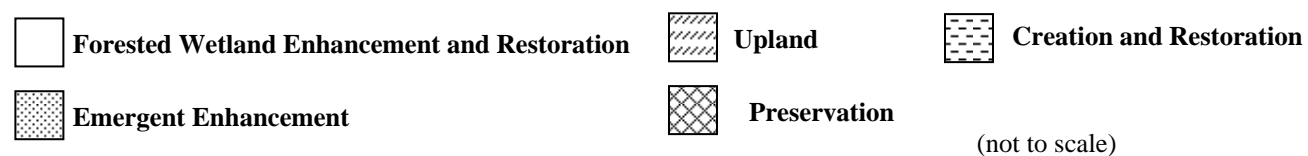
Habitat structures were counted to address Performance Standard 9.

Sample size analysis confirmed sufficient sampling had been completed based on site sampling objectives and the desired level of statistical confidence. The sample size equation shown here (right previous page) was used to perform this analysis.

For additional details on the methods described above view WSDOT Wetland Mitigation Site Monitoring Methods at:
<http://www.wsdot.wa.gov/environment/biology/docs/MethodsWhitePaper052004.pdf>

Appendix 3 - Data Figures and Tables

Figure 1 SR 18 Jenkins Creek Mitigation Site sketch with hydrology pit locations.



Appendix 3 - Data Tables (continued)

Table 1 Summary of hydrology observations in March and April 2006.

	Pit 1	Pit 2	Pit 3	Pit 4	Pit 5
1-03/08/06	No standing water present in hole at 18" after 40 minutes.	No standing water present in hole at 18" after 40 minutes. Soil moist but not saturated.	Area around pit 3 inundated to 1-2 dm. No pit needed.	Area around pit 4 inundated to 1 dm. No pit needed.	No standing water present in 18" hole after 40 minutes.
2-03/29/06	Soils moist after 40 minutes.	Soils moist after 40 minutes	Standing water in pit instantly at 6". Standing water @ 4" after 30 minutes	Saturation to the surface, no pit needed.	Soils moist after 25 minutes.
3-04/10/06	No water at 18" below soil surface after 1 hour.	No water at 18" below soil surface after 1 hour.	3" of water at the deepest point in the depression (no pit needed.).	Saturated to the surface. Standing water at 7" below soil surface after 1 hour.	No water at 18" below soil surface after 1 hour.
4-04/25/06	No water in pit after 45minutes- soils only moist at 17".	No water in pit after 45minutes- soils only moist at 17".	2" of water at the deepest point in the depression (no pit needed).	Standing water in pit instantly at 11" below the soil surface. Soil saturation to the surface. Standing water in pit at 9" below the soil surface after 40 minutes.	No water at 17" after 35 minutes. Soils only moist.

Appendix 3 - Data Tables (continued)

Table 2 Native Woody Species Observed in the Forested Wetland Zone in 2005

Scientific Name	Common Name	Wetland Indicator Status
<i>Alnus rubra</i>	red alder	FAC
<i>Cornus sericea</i>	redosier dogwood	FACW
<i>Crataegus douglasii</i>	black hawthorne	FAC
<i>Frangula purshiana</i>	Cascara	FAC-
<i>Fraxinus latifolia</i>	Oregon ash	FACW
<i>Lonicera involucrata</i>	Twinberry	FAC+
<i>Physocarpus capitatus</i>	Pacific ninebark	FACW-
<i>Picea sitchensis</i>	Sitka spruce	FAC
<i>Populus balsamifera</i>	black cottonwood	FAC
<i>Pseudotsuga menziesii</i>	Douglas-fir	FACU
<i>Rubus spectabilis</i>	Salmonberry	FAC+
<i>Salix lucida</i>	Pacific willow	FACW+
<i>Salix scouleriana</i>	Scouler's willow	FAC
<i>Salix sitchensis</i>	Sitka willow	FACW
<i>Spiraea douglasii</i>	Hardhack	FACW
<i>Thuja plicata</i>	western red cedar	FAC

Appendix 3 - Data Tables (continued)

Table 3 Native Woody Species Observed in the Buffer Zone in 2005

Scientific Name	Common Name	Wetland Indicator Status
<i>Abies grandis</i>	Grand Fir	FACU-
<i>Acer circinatum</i>	vine maple	FAC-
<i>Acer macrophyllum</i>	bigleaf maple	FACU
<i>Alnus rubra</i>	red alder	FAC
<i>Crataegus douglasii</i>	black hawthorne	FAC
<i>Crataegus monogyna</i>	oneseed hawthorn	FACU+
<i>Cornus sericea</i>	redosier dogwood	FACW
<i>Frangula purshiana</i>	cascara	FAC-
<i>Fraxinus latifolia</i>	Oregon ash	FACW
<i>Lonicera involucrata</i>	twinberry	FAC+
<i>Mahonia aquifolium</i>	tall Oregon grape	NL
<i>Mahonia nervosa</i>	short Oregon grape	NL
<i>Physocarpus capitatus</i>	Pacific ninebark	FACW-
<i>Picea sitchensis</i>	Sitka spruce	FAC
<i>Populus balsamifera</i>	black cottonwood	FAC
<i>Pseudotsuga menziesii</i>	Douglas-fir	FACU
<i>Rubus spectabilis</i>	salmonberry	FAC+
<i>Spiraea douglasii</i>	hardhack	FACW
<i>Symphoricarpos albus</i>	snowberry	FACU

Appendix 3 - Data Tables (continued)

Table 4 Native Herbaceous Species Observed in the Emergent Wetlands in 2005

Scientific Name	Common Name	Wetland Indicator Status
<i>Alopecurus pratensis</i>	meadow foxtail	FACW (non-native)
<i>Carex stipata</i>	sawbeak sedge	OBL
<i>Carex obnupta</i>	slough sedge	OBL
<i>Eleocharis ovata</i>	ovate spikerush	OBL
<i>Hypericum anagalloides</i>	bog St. Johnswort	OBL
<i>Impatiens noli-tangere</i>	yellow touch-me-not	FACW
<i>Juncus acuminatus</i>	tapertip rush	OBL
<i>Juncus articulatus</i>	jointleaf rush	OBL
<i>Juncus effusus</i>	soft rush	FACW
<i>Lysichiton americanus</i>	skunkcabbage	OBL
<i>Myosotis laxa</i>	bay forget-me-not	OBL
<i>Schoenoplectus tabernaemontani</i>	soft-stem bulrush	OBL
<i>Sparganium angustifolium</i>	narrowleaf bur-reed	OBL
<i>Veronica americana</i>	American speedwell	OBL
<i>Veronica scutellata</i>	scullcap speedwell	OBL

Appendix 3 - Data Tables (continued)

Table 5 Bird Species Observed in During the Monitoring Period

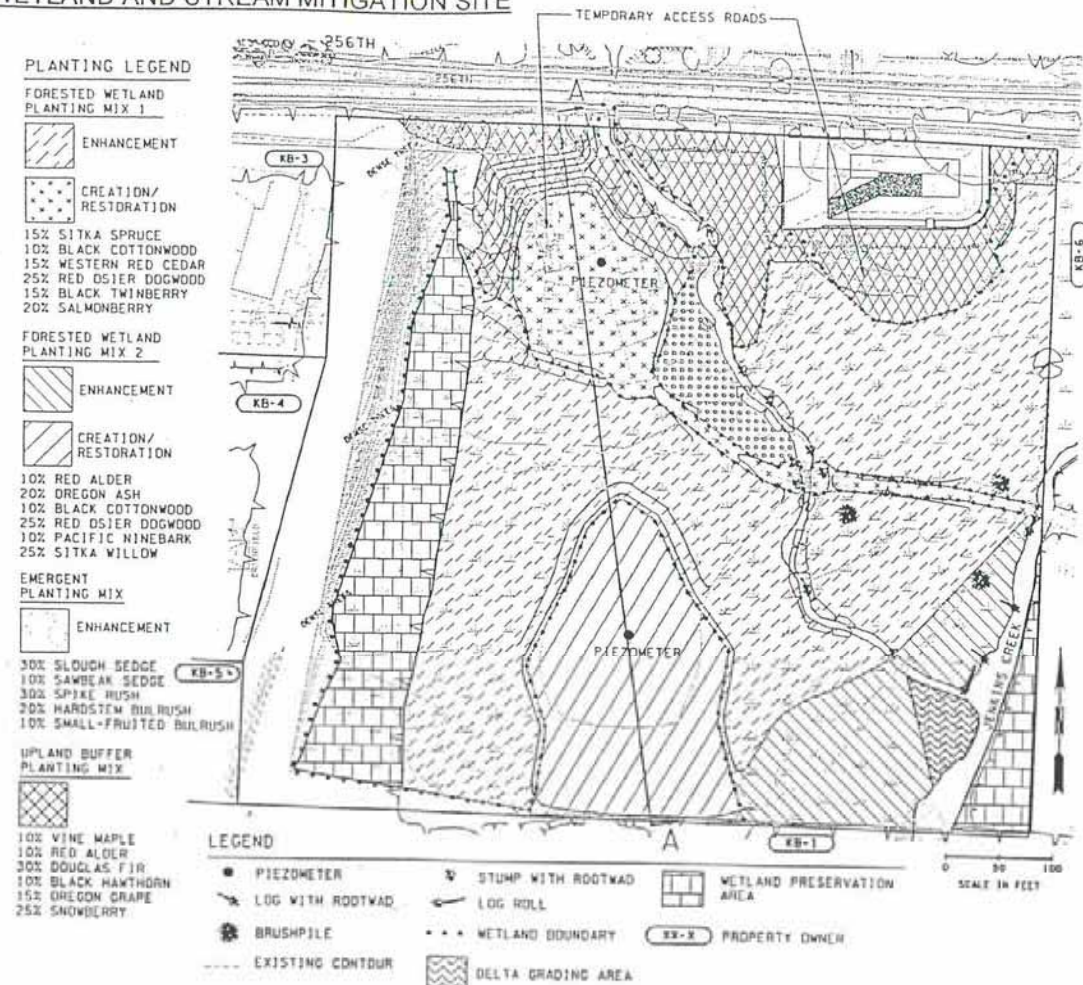
FAMILY NAME	COMMON NAME	SCIENTIFIC NAME	STATUS ¹
<i>Ardeidae</i>	Great Blue Heron	<i>Ardea herodias</i>	Wetland-dependent
<i>Accipitridae</i>	Red-tailed hawk	<i>Buteo jamaicensis</i>	
<i>Charadriidae</i>	Killdeer	<i>Charadrius vociferus</i>	Wetland-associated
<i>Alcedinidae</i>	Belted Kingfisher	<i>Ceryle alcyon</i>	Wetland-dependent
<i>Picidae</i>	Northern Flicker	<i>Colaptes auratus</i>	
	Pileated Woodpecker	<i>Dryocopus pileatus</i>	
<i>Tyrannidae</i>	Willow Flycatcher	<i>Empidonax traillii</i>	Wetland-associated
	Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	
<i>Corvidae</i>	Steller's Jay	<i>Cyanocitta stelleri</i>	
	American Crow	<i>Corvus brachyrhynchos</i>	
<i>Hirundinidae</i>	Tree Swallow	<i>Tachycineta bicolor</i>	Wetland-associated
<i>Paridae</i>	Black-capped Chickadee	<i>Poecile atricapillus</i>	Wetland-associated
<i>Troglodytidae</i>	Bewick's Wren	<i>Thryomanes bewickii</i>	
	Marsh Wren	<i>Cistothorus palustris</i>	Wetland-dependent
<i>Turdidae</i>	American Robin	<i>Turdus migratorius</i>	
<i>Bombycillidae</i>	Cedar Waxwing	<i>Bombycillia cedrorum</i>	
<i>Parulidae</i>	Common Yellowthroat	<i>Geothlypis trichas</i>	Wetland-dependant
<i>Emberizidae</i>	Spotted Towhee	<i>Pipilo maculatus</i>	
	Savannah Sparrow	<i>Passerculus sandwichensis</i>	
	Song Sparrow	<i>Melospiza melodia</i>	
	White-crowned Sparrow	<i>Zonotrichia leucophrys</i>	

¹ Birds are assigned a wetland-dependent and wetland associated status based on habitat preference and the classification scheme presented in Brown and Smith (1998). Regional variation occurs. References used to further classify species include Thomas (1979), Ehrlich et al. (1988), Smith et al. (1997), and other sources.

Appendix 4 – Planting Plan

(Antieau and Krueger 2001)

WETLAND AND STREAM MITIGATION SITE



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